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LAMELLIBRANCHIA) FROM THE UPPER
CRETACEOUS OF TURKEY

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TWO NEW RADIOLITIDS (RUDISTID LAMELLIBRANCHIA) FROM THE UPPER CRETACEOUS OF TURKEY

By L. R. Cox

SYNOPSIS

The species described are of late Cretaceous (Campanian or Maastrichtian) age. One, *Parasawagesia cappadociensis* gen. et sp. nov., is made the type of a new genus thought to be derived from *Sawagesia*; it resembles that genus in the retention of a ligamental ridge, but differs from it in having small pseudo-pillars which are, however, less complex than those of *Lapeirousia*. The second species, *Praeradiolites gordonae* sp. nov., is the largest known representative of its genus.

RUDISTS from the Upper Cretaceous rocks of Turkey have been described in several papers by previous authors. So long ago as 1855 S. P. Woodward based descriptions of four species of the genus *Hippurites* (*H. loftusi*, *H. colliciatius*, *H. corrugatus* and *H. vesiculosus*) on material collected by W. K. Loftus at a locality Hakim Khan [Hekimhan], about 135 km. SE. of Sivas, in central Turkey. These species, which are now known to be common throughout the country, have been re-described by Douvillé (1890-97), who examined part of the original material, preserved in the British Museum (Natural History), and by Toucas (1903-04). Böhm's (1927) monograph of a series of fossils (now in the same museum) from the Bithynian peninsula, in NW. Turkey, included descriptions of Senonian rudists referred to *Sabinia*, *Schiosia*, *Hippurites* (*H. vesiculosus* was represented), *Praeradiolites*, *Radiolites*, *Biradiolites*, and *Durania*. Among fossils from the neighbourhood of Eregli, in northern Turkey, described by Nöth (1931) were species of *Praeradiolites*, *Radiolites*, *Biradiolites*, *Sphaerulites*, and *Hippurites* (*H. vesiculosus* was again present). Stchépinsky (1941, 1942) recorded a number of rudist species from localities in northern Turkey; they included *Hippurites loftusi* and two species, *H. cornuvaccinum* Bronn and *Lapeirousia jouanneti* (Desmoulins), well known in Europe but not previously found in Turkey. Rudists from southern Turkey described by the same author in 1944 included Woodward's four hippurite species, together with *Lapeirousia jouanneti* and a remarkable form which Vautrin (1933) had found in material from northern Syria and described as *Lapeirousia syriaca*. This last form, which has proved to be widespread in the Upper Senonian of Turkey, was made the type of a new genus *Vautrinia* by Milovanović (1938: 88).¹

¹Milovanović (1938: 137) also erected a new genus *Kelleria* for specimens from Syria identified by Keller (1933: 50, pl. 3, fig. 3; pl. 4, figs. 2) as *Lapeirousia jouanneti*, although he did not assign a new specific name to them. He considered their generic separation from *L. jouanneti* to be justified by their elevated, cornucopia-like form, their non-foliaceous surface bearing only strong growth-rugae, and the relatively thinner wall of their shell where it encloses the body-cavity. Stchépinsky (1944: 235), however, states that in Turkish specimens which he assigns to *L. jouanneti* the form of the lower valve ranges from depressed-conical (as in typical French specimens of the species) to high and sub-cylindrical. It would thus appear that the status of the genus *Kelleria* needs re-consideration.

In Stchépinsky's (1946) atlas of characteristic fossils of Turkey many of his previous figures of Cretaceous rudists are reproduced and others added. Reference may, finally, be made to papers by Tromp (1941) and Erentöz (1949) in which the stratigraphical distribution of some of the well-known species of *Hippurites* in Turkey is discussed. Tromp doubted if their range was as restricted as had been supposed. Erentöz considered that *H. vesiculosus* and *H. corrugatus* were good index fossils, characteristic of the Campanian rather than of the Maastrichtian, as thought by some workers, including Stchépinsky.

The present paper consists of the description of two interesting rudists, one belonging to a new genus, which have come to my notice while examining recent collections from Turkey. The type specimens of the first of these, *Parasauvagesia cappadociensis* gen. et sp. nov., were collected by geologists of the Bataafse Internationale Petroleum Maatschappij N.V. and generously presented by that Company to the Department of Palaeontology of the British Museum (Natural History). The holotype of *Praeradiolites gordonae* was collected and presented to the same museum by Miss V. Gordon, of the University of Ankara.

Family RADIOLITIDAE

Genus *PARASAUVAGESIA* nov.

Generic name. Intended to suggest probable affinity with *Sauvagesia* Douvillé, 1886, presumably named after the French palaeontologist H. E. Sauvage.

DIAGNOSIS.—Lower (right) valve depressed-conical, longitudinally costate, lacking growth-imbrications or readily distinguishable siphonal bands; prismatic cells of outer layer of shell-wall with longitudinal orientation, appearing in transverse section as a polygonal network; a short ligamental ridge and two weakly developed pseudo-pillars present; upper (left) valve with a central elevation and a broad, more or less flattened rim; no oscules.

TYPE SPECIES. *Parasauvagesia cappadociensis* sp. nov., Campanian or Maastrichtian, Turkey.

Parasauvagesia cappadociensis sp. nov.

(Pl. 61; Pl. 62, fig. 2)

Specific name. After the kingdom and later Roman province of Cappadocia, which occupied part of what is now eastern Turkey.

MATERIAL. The holotype (British Museum (Natural History), Department of Palaeontology, No. LL.10503) and one paratype (No. LL.10504).

DESCRIPTION. The lower (right) valve is very broadly conical in form and almost circular in cross-section. The holotype, the larger of the two specimens, is 80 mm. long and has a maximum diameter of 175 mm. The upper (left) valve in this specimen is hat-like in shape, with a central dome-like elevation which is about 25 mm. high and 83 mm. in maximum diameter and is surrounded by a flattened rim 40–50 mm. wide and very thin at its margin. The inner part of the rim is slightly

depressed in places, but this may be a result of pressure during fossilization. The margin of the upper valve forms an unbroken curve and there is no trace of oscules. The lower valve bears numerous depressed, rounded longitudinal costae which number 3-4 to the cm. at the commissure and are separated by relatively narrow intervals. It also has very irregular growth-corrugations but no imbricating lamellae. No siphonal bands are recognizable, a narrow longitudinal depression being so irregular that it seems to be merely a surface rugosity of no significance. The upper valve is unornamented except for weak marginal corrugations.

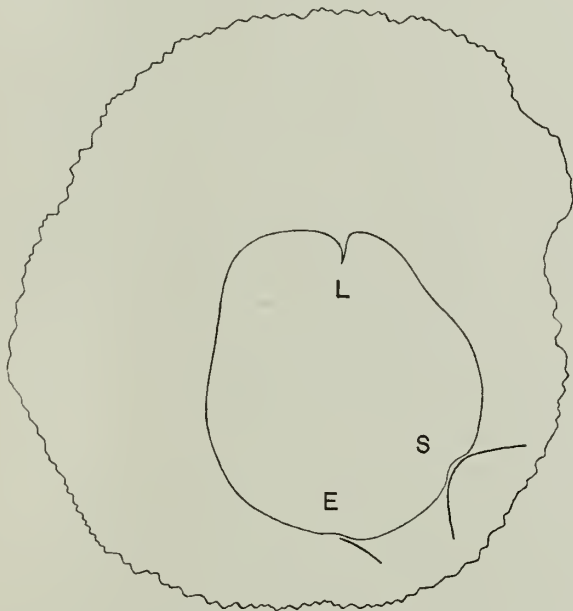


FIG. 1. *Parasawagesia cappadociensis* gen. et sp. nov. (Brit. Mus. Palaeont. Dept. no. LL.10504). Transverse section of lower valve 15-20 mm. below commissure ($\times 0.75$); showing ligamental ridge (L) and small pseudo-pillars marking positions of inhalant and exhalant zones (E, S). For details of structure of shell wall near S see Pl. 62, fig. 2.

In the paratype the lower valve (now sectioned) was originally about 50 mm. long and its maximum diameter at the commissure is about 155 mm. Its ornament is similar to that of the holotype. The upper valve is less perfect than in the holotype, but its central elevation can be seen to be less dome-like than in that specimen and to merge more gradually into the rim.

A transverse section of the paratype, cut 15-20 mm. below the commissure, shows a small ligamental ridge about 4 mm. long, which is curved slightly in an anterior direction and much attenuated distally, with a thorn-shaped cross-section (Text-fig. 1). Exactly opposite the ligamental ridge the wall of the shell, which is here much thinner than on the ligamental side, has a very slight inward bulge, while

some distance posterior to this is a second and more marked (although by no means prominent) bulge. These bulges are similar in form and position to the so-called "pseudo-pillars" present in a number of previously described radiolitid genera, such as *Sphaerulites* and *Lapeirousia*, and it is suggested that they are of the same nature as these. According to the theory now generally accepted, they would thus mark the positions of openings in the mantle edge of the animal for the passage of inhalant and exhalant currents, or possibly of definite inhalant and exhalant siphons. As is usual in rudist descriptions, they may thus be designated (following French authors) by the letters "E" and "S" (*entrée* and *sortie*). When (as in *Lapeirousia*) oscules in the upper valve correspond to the two pseudo-pillars, some authors have suggested that the respiratory currents (or the siphons, if any existed) passed through them. In the present case, as in most radiolitids, oscules are absent and there are no gaps between the two valves when the upper one is in position. Hence respiration could have taken place and the siphons (if any) extended only when the upper valve was raised.¹

The structure of the wall of the lower valve is clearly preserved in a number of places in the sectioned specimen. The cross-section (Pl. 62, fig. 2) shows a polygonal mesh such as is well developed in the genera *Sauvagesia* and *Durania*, the average breadth of the polygons being about 0.5 mm. On the ventral side, between the bulges "S" and "E" and on the posterior side of the former, the inner surface of the wall is lined with a series of more regular, subrectangular cells which are oriented radially, their length (in a radial direction) slightly exceeding their width. These cells are larger than those forming the polygonal mesh. Elsewhere, however, the corresponding innermost cells are of much the same size as those of the general mesh or even smaller than them. Modifications of the structure of the shell wall where the pseudo-pillars occur are indicated by the presence of a thin parabolic arc (Pl. 62, fig. 2) of denser and probably lamellose shell matter which touches the inner margin of the wall where "S" projects, and of what appears to be part of one side of a corresponding parabola located in a similar position in relation to "E". The prismatic cells within the parabolas are mostly similar in size and arrangement to those on the rest of the wall, but near the actual bulges they become, on the average, slightly smaller.

It seems probable that certain structures visible within the body-cavity in the cross-section are accidental accumulations of crystalline calcite and not sections of teeth and myophores projecting from the upper valve. They are not, therefore, indicated in the Text-figure.

AFFINITIES. The polygonal mesh seen in the cross-section of the shell wall indicates that this radiolitid is most closely related to the group of genera (*Sauvagesia*, *Durania* and *Lapeirousia*) which Douvillé (1910: 28) proposed to include in a "rameau" Sauvagésinés. It resembles *Sauvagesia* in the retention of a ligamental ridge, but it is distinguished from any species of that genus hitherto described by its

¹Since it is uncertain if the radiolitids were siphonate, the term "siphonal bands", commonly applied to longitudinal modifications (not detectable in the present species) of the exterior of the lower valve designated (for reasons just explained) as "E" and "S", is not a happy one, but seems too firmly established to be discarded.

very depressed form and by the absence of clearly differentiated siphonal bands; the presence of distinct pseudo-pillars accompanied by definite although slight modifications of the structure of the shell wall seems to justify its separation as a distinct genus. Its very depressed form and the presence of the pseudo-pillars are suggestive of *Lapeirousia*, which, together with some related genera, has been discussed in interesting papers by Milovanović (1938, 1951). In *Lapeirousia*, however, a ligamental ridge is absent except in the oldest known species, *L. aumalensis* Douvillé, the pseudo-pillars are more prominent than in the species now described, and their structure, well illustrated by Milovanović, is much more complicated.

Douvillé (1910: 26) suggested that *Lapeirousia* was derived from *Durania*, and this view has been accepted by Moret (1936: 164–166). Wiontzek (1934: 28), however, described a supposedly ancestral genus *Praelapeirouseia*. Milovanović (1938: 131–143) has pointed out that *Lapeirousia* includes species which are more primitive in certain characters than either of the genera in question—than *Durania* in the retention of a ligamental ridge, than *Praelapeirouseia* because in that genus the pseudo-pillars have a highly specialized structure. In his view, in fact, *Lapeirousia* arose directly from *Sauvagesia*, from which the other genera just mentioned were derived independently. The new genus now described appears to have some bearing on the subject since it is intermediate between *Sauvagesia* and *Lapeirousia* in some morphological characters—the retention of a ligamental ridge combined with the presence of small pseudo-pillars and with a very depressed form. Unless, however, it is represented, by species yet to be discovered, in much older geological deposits than those (of Campanian or Maastrichtian age) in which its type species was found, it could scarcely have been an evolutionary link between those genera, since *Lapeirousia* is known to occur in strata as old as Turonian. The structure of the shell wall where the pseudo-pillars are situated differs, moreover, from that found in *Lapeirousia*, as comparison of Pl. 62, fig. 2, of the present paper with the figures of Milovanović (1938) will show. In *Lapeirousia* the cellular network behind each pseudo-pillar is interrupted by a broad arc of lamellose shell substance, the convex side of which faces towards the exterior of the shell, and between which and the outer surface there is a radial interruption of the continuity of the cellular structure of the wall. In the form now described, on the other hand, there is a thin, inward-facing arc of lamellose shell substance with no interruption of the cellular structure between it and the outer surface. The absence of oscules in the upper valve also distinguishes the present form from *Lapeirousia*.

It would thus appear that the new genus *Parasauvagesia* arose in late Cretaceous times as an offshoot from *Sauvagesia* which followed evolutionary trends towards the development of a broad, depressed shell and of pseudo-pillars which had already been pursued by *Lapeirousia* and (in the case of the pseudo-pillars) elaborated upon to a much greater extent. The retention of a ligamental ridge shows that it cannot, like *Lapeirousella* Milovanović (1938: 89, 112, pl. 4, fig. 2; pl. 5, fig. 2), be regarded as a degenerated *Lapeirousia*.

OCCURRENCE. Campanian or Maastrichtian, Zergüz, 13 km. SW. of Cermik and about 70 km. WNW. of Diyarbakir, SE. Turkey (holotype); about same horizon, Acme, 8 km. E. of Gerger and about 130 km. W. of Diyarbakir (paratype).

Genus *PRAERADIOLITES* Douvillé, 1903

Praeradiolites gordonae sp. nov.

(Pl. 62, figs. 1a, b)

Specific name. Named after Miss V. Gordon, of the University of Ankara, collector of the holotype.

DIAGNOSIS. A *Praeradiolites* characterized by its large size (length over 30 cm.), its widely separated, thick, funnel-like imbricating growth-layers and its convex upper valve.

MATERIAL. The holotype only (British Museum (Natural History), Department of Palaeontology, No. LL.9568).

DESCRIPTION. As now preserved, the lower valve, which is acutely conical and slightly curved in a ventral direction, is about 25 cm. long; as, however, its lower end is broken away, its original length must have well exceeded 30 cm. Its cross-section is roughly elliptical, the maximum diameter at its upper end being 10.5 cm. and its minimum (dorso-ventral) diameter 8 cm. The relatively thick outer layers of the shell imbricate upwards at irregular and, on the average, rather distant intervals, forming, as it were, a series of cones or funnels each projecting from the one below it. The upper end of each funnel, as now preserved, does not curve outwards so as to be quite out of contact with the one projecting from it, but this is probably due to the fact that the specimen is somewhat worn. For the same reason, the siphonal zones which should lie on the ventral side of the specimen are not distinguishable.

The thick upper valve, which is distinctly although not strongly convex, fits obliquely on the lower valve, sloping downwards from its dorsal side. Although its position is not clearly seen, the umbo was evidently either marginal or very close to the dorsal margin. On the ventral side the margin of this valve has two sinuses, probably indicating where the respiratory currents entered and left the pallial cavity. The sinus which on this supposition may be designated as "E" is deeper than the other one ("S").

REMARKS. This is the largest *Praeradiolites* known to me. With its well separated, funnel-like growth layers, each projecting from the one below, it much resembles *P. cylindraceus* (Desmoulins), of the Maastrichtian, and it particularly recalls a specimen of that species figured by Toucas (1907, pl. 7, fig. 7). *P. cylindraceus*, however, has a flat upper valve without marginal sinuses and with a central nucleus which does not project as a distinct umbo. The upper valve of the form now described is more like that of the Santonian species *Praeradiolites plicatus* (Lajard, Négrel & Toulouzan), but in that form the imbricating funnel-like layers of the lower valve are more closely arranged.

OCCURRENCE. Campanian or Maastrichtian (associated with *Hippurites (Vacinites) loftusi* Woodward), Inali Bogaz, 17 km. from Kalecik on road to Cankiri, and about 60 km. ENE. of Ankara, Turkey.

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